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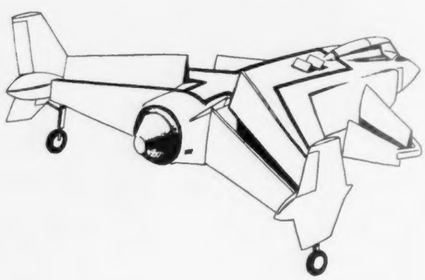
approach

OCTOBER 1974 THE NAVAL AVIATION SAFETY REVIEW

The modern serviceman is under almost constant bombardment from strings of acronyms. Most have meanings only for specialists in the fields to which they belong, but some are passing into everyday language. Among these are terms describing the takeoff and landing capabilities of modern aircraft: STOL (short takeoff and landing), VTOL (vertical takeoff and landing), and VSTOL (vertical or short takeoff and landing).

Some, but by no means all, light aircraft have been STOL for years. Nevertheless, there is as yet no generally agreed-upon definition of the "S" in STOL. (How short is short? Is a "homebuilt" leaving the ground after a 350-foot run with two people onboard really in the same category as a Breguet 941 lifting 22,000 pounds after a run only twice as long?) It is usually accepted that when talking about STOL aircraft, one is referring to aircraft whose takeoff and landing performance is significantly better than a "conventional" aircraft of the same class. Such improvements are unlikely to be made without the use of special high-lift devices.

"V" is easier. A VTOL aircraft could be defined (though probably has not been) as one which can take off and land without damage with the brakes on. Helicopters have been doing it for years.



VS

THE DREAM was of an aircraft which could take off and land vertically and yet match the performance of conventional machines in flight. Most early jet lift designs were of the "flying bedstead" type: engine (or engines), fuel tanks, controls, instruments, and seat located in a framework of girders and tubes. Aerodynamics were forgotten since these vehicles were intended only to explore flight in the hover and at low translational velocities. In any case, the fuel states at which most of them were capable of hovering would scarcely have allowed enough flying time for transition to wingborne flight and back again.

Once it had been shown that control of such a device in jetborne flight was surprisingly easy, even without artificial stability augmentation, a host of experimental aircraft took to the skies to try to find the best way of doing it.

There were tail-sitters and wire-hangers, wings with fans in them, wings that tilted, engines that tilted, turbo-props, fan engines and pure jets; aircraft with lift engines in the fuselage, and others with lift engines at the wingtips. Civil designers thought they saw the dawn of the age of city-center VTOL operations. Many studies were made of suitable landing sites, new aircraft designs, and possible modifications to existing ones. It was, however, a false alarm. For many reasons – technical, financial, and environmental – the time for intercity VTOL operations has not yet come, though some day it undoubtedly will.

In October 1960, the first tethered hovering trials were conducted on the prototype P1127 which was the lineal ancestor of the Hawker Siddeley *Harrier* in service today with the Royal Air Force and the United States Marine Corps. The concept was simple and effective. A single, high bypass ratio fan engine directed the hot gas flow from the turbine and the cold gas flow from the fan through two separate pairs of nozzles. The nozzles could be swiveled in unison from fully aft, downwards through the vertical to a small forward angle. A single lever in the cockpit gave the pilot continuous control of the thrust vector angle between these limits. High pressure air was bled from the compressor to reaction control valves at the nose, tail, and wingtips for control in the hover and at low speeds.

These principles have remained essentially unchanged through the development of the P1127 into the Kestrel and finally the *Harrier,* which remains today, nearly 14 years after the P1127 first flew, the only operational jet

The author at the controls of the prototype P1127.
Crown copyright RAE Bedford

TOL

By LCDR C. A. Wheal, Royal Navy
Naval Safety Center

VSTOL aircraft in the Western world. The system is known as the vectored thrust or lift-cruise system.

The *Harrier* was developed as a low level ground attack aircraft with the unique ability to land and take off from minimally prepared forward sites not much larger than the aircraft itself – short stretches of road, the decks of small ships, etc. When forced (by site restrictions) to take off vertically, its payload and/or range are somewhat limited; but when circumstances permit a takeoff run of a few hundred feet, it can carry an acceptable weapon load a respectable distance.

The high thrust/weight ratio of the *Harrier* (greater than one when the aircraft is at hover weight) gives it very good performance in its primary operating zone. In addition, the ability to vector the thrust in forward flight goes a long way towards making up for its otherwise indifferent turning performance and permits evasive maneuvers which are highly effective against a conventional attacker. The high bypass ratio engine which is crucial to the concept, however, imposes severe performance limitations at high altitude or high speed due to the large momentum drag of the intake.

The *Harrier* has been called, somewhat disparagingly, the "Tin Lizzie" of the VSTOL era. Unlike the original Tin Lizzie, however, the *Harrier* has the excellent potential for further design development. The AV-16, at present under study by Hawker Siddeley and McDonnell Douglas, represents a considerable advance on the AV-8A now in service. According to information so far released, it should double the payload or flight radius of the AV-8A and be capable of Mach 1.5 with PCB (plenum chamber burning) or Mach 2.0 with PCB and afterburning. Plenum chamber burning is supplementary burning in the cold flow from the fan which exhausts through the front nozzles. An earlier development engine, the BS100 (intended for the P1154 but cancelled in 1965), achieved 30,000 pounds of thrust on the test bed running with PCB.

A criticism often leveled at the *Harrier* and other lift-cruise designs is that the engine, being sized for vertical takeoff and landing, is necessarily oversized for cruise conditions. This results in a weight penalty and a decrease in efficiency because the engine is run at lower than optimum RPM in the cruise. For a tactical aircraft, these drawbacks are not nearly as serious as they are made out to be by the aircraft's detractors. High excess power never hurt any combat aircraft, while the allegedly poor engine efficiency in the cruise still

produces specific air ranges comparable to or better than other aircraft in the role.

Nevertheless, for some applications, the lift-cruise system may be less than ideal, for example, on transport-type aircraft where the installed weight of two or more vectored-thrust fan engines sized for vertical operations may impose a serious penalty compared with the weight of an installation optimized for the cruise. In such a case, the penalty may be significantly reduced by sizing the vectored thrust unit(s) for cruise conditions and supplementing the lift thrust with cheap, lightweight, short-life lift engines such as the RB 162 and 202 series. Such a system would be described as lift plus lift/cruise. (If the thrust of the propulsion engine(s) was not vectorable, the system would become lift plus cruise.)

This layout might have advantages in a design for very high speeds because of the reduction in frontal area and intake momentum drag. For a tactical aircraft, it may be that such assumed advantages are outweighed by increased complexity and the deadweight penalty of carrying (nonjettisonable) lift engines in combat. The possible consequences of battle damage must also be considered, bearing in mind that the loss of a single lift engine will almost certainly mean that at least one other cannot be used or uncontrollable moments will be generated.

Various experimental aircraft making use of these concepts have flown in the last 15 years or so, including the Short SC1 (lift plus cruise in five RB 108s), the German VFW-VAK 191 (lift plus lift-cruise: one RB/MTU-193 thrust vectored turbofan and two RB-162s), the VJ-101 (lift plus lift-cruise: six RB-145s), and the Dornier DO-31 (lift plus lift-cruise: two Pegasus and eight RB-162s). They have, however, all been experimental vehicles, and no development/production contracts using these concepts have been forthcoming.

Any form of jet lift has certain fairly serious drawbacks because of the hot, high velocity efflux. The most obvious is perhaps noise, though outside civil applications, it is probably not one of the more serious. More important are the ground erosion and FOD-inducing effects, the loss of performance resulting from hot gas ingestion, and the inherently low efficiency of generating lift by accelerating a relatively small mass of air to a high velocity. Considering a single, cylindrical column of efflux, the power required to hover at a given weight is inversely proportional to the column diameter and directly proportional to efflux velocity. The efflux velocity required is inversely proportional to the mass

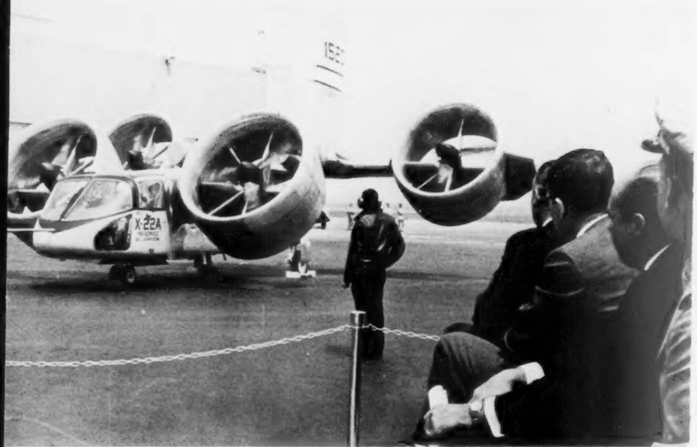
flow which in turn is inversely proportional to temperature. Thus, any changes we can make towards increasing mass flow will, for a given aircraft weight, enable us to slow down the efflux. This will, in turn, reduce the power requirements and, hence, the hover fuel consumption. The increasingly large proportion of ambient air cools the efflux, which in turn increases the mass flow. The simplest way of achieving these desirable ends is to increase the diameter of the efflux, since mass flow varies directly with the *square* of the diameter and directly with the efflux velocity. Ultimately, we arrive at the helicopter which gains its lift by accelerating a large mass of air to a comparatively low velocity for a very low power requirement.

In general, the higher the mass flow (i.e., the larger the diameter of the propelling mechanism, whether rotor, fan, or turbine exhaust nozzle), the slower and cooler we can make the efflux, thereby reaping the benefits of increased efficiency coupled with decreased noise, ground erosion, FOD risk, hot gas reingestion, and personnel hazard.

The principle of entrainment of ambient air has been applied in several aircraft ranging from the fan-in-wing Ryan XV-5 to various tilt-prop and tilt-wing designs with variously ducted and inducted rotors. (The dividing line between jet lift and rotor or prop lift becomes a little blurred here. Does a fan-in-wing, tip-driven from a turbine gas generator, differ in kind from a similar fan which happens to be mounted on a concentric shaft with the gas generator and driven by its air turbine? Is there any inherent difference, other than the number of blades, between a ducted propeller and a ducted fan?)

So far, despite the apparent success of their flight test programs, none of these aircraft have yet attracted enough money or official enthusiasm to be developed beyond the prototype stage. Nevertheless, a concept which could reconcile the conflicting requirements for hover and supersonic operations in one design is at present under development by Rockwell International as the XFV-12A. In the hover and transition regimes, the entire efflux from a conventional turbojet is diverted to spanwise ducts in the lifting surfaces (wing and canard foreplane). A spanwise venturi throat is created by deflecting flaps ahead of and behind the duct, and the efflux gas is ejected downwards through slots in the ducts. This high velocity flow entrains about eight times its own mass of ambient air and thereby generates an increase in lifting thrust over that available from the engine alone. It also cools and slows down the flow, serving to both quiet it and reduce its propensity for kicking up FOD and digging holes in unprepared surfaces.

Thrust modulation is achieved (at constant engine



RPM) by varying the constriction of the duct throats, while thrust vector angle is controlled by varying the mean deflection of the flaps forming the ducts. Control in the hover and transition to forward flight is by appropriate combinations of differential thrust modulation and variations of thrust vector angle. In wingborne flight, the engine operates as a conventional, afterburning turbojet, and the aircraft has been designed to reach speeds on the order of Mach 2.

The first prototype is expected to fly conventionally during the spring of 1975. The second prototype will begin hover and transition work later in the year. If the successful laboratory, wind tunnel, and test rig results can be translated into practical airborne hardware, the augmentor wing concept would become the first truly original solution to the problems of achieving genuine high performance from a VTOL aircraft without incurring disproportionate penalties in fuel consumption, noise, erosion, etc.

The company has proposed a variety of other aircraft types using the same principle, ranging from ASW vehicles to medium-sized transport aircraft. It is not inconceivable that, if the noise footprint turns out to be as small as is hoped, the concept may find application in the VSTOL field and perhaps revitalize the hopes of the sixties for eventual city-center VTOL operations.

Thus, it can be seen that present day VSTOL technology has many common features with aviation technology at the turn of the century. Many diverse ideas have been tried, and many more no doubt will be. Most of these, as the more outlandish designs of the early 1900s, have been consigned to the junkheap; but a small handful have shown themselves to be sensible and practical, even though in some cases they may not warrant full development for a few years yet. Tears need not be shed over the demise of the early tail-sitters and wire-hangers, and it is hoped that no one is misguided enough to try to revive them. Apart from formidable ground handling problems inherent in such designs (which would be magnified to an intolerable extent at sea), the pilot's task is made unnecessarily difficult by demanding that he approach touchdown in the direction of maximum restriction of view. These and other problems do not arise with "conventional" VTOL designs, whose only penalty is the need to generate thrust in a vertical direction – a problem by now well understood.

As practical VSTOL designs emerge from the research and development programs of the past 10-20 years, it may be surmised that the next few decades will see increasingly widespread use of jet VSTOL aircraft. The advantages of not being tied either to long strips of concrete or to catapults and arresting gear apply equally to civil and military operations, though for different reasons.

The military commander can disperse his forces so as to make them virtually undetectable, can operate them from minimally prepared sites close to the battle zone, and, at sea, will have nearly as wide a choice of landing platforms and "spare decks" as if he were operating helicopters.

In the civil field, it is likely that VSTOL will only slowly be applied to larger aircraft so that, at first, the probable applications will be to feeder liners and small transports. Even this could provide welcome relief from the need for ever larger areas of land to be buried under concrete. Ultimately, perhaps, our children, in their old age, may see hydrogen-fueled VTOL supersonic transports operate routinely on intercontinental flights.

There was a catch phrase amongst the VSTOL test pilots at RAE Bedford some years ago to the effect that what the world needed was a cheap, silent, reliable, antigravity unit. We don't have it yet, but the next few years may see considerable steps taken towards an acceptable substitute. ◄

Bravo Zulu

LT Steve Gant and LTJG John Bond, VA-95

LT GANT and his B/N, LTJG Bond, were engaged in visual dive-bombing practice at an offshore target near NAS Cubi Point. While recovering from their third run, they were alerted by illumination of the starboard firewarning light. LT Gant quickly secured the starboard engine, while LTJG Bond informed their section leader of the situation.

Realizing that their night recovery time aboard CORAL SEA (nearly 100 miles at sea) was still 45 minutes away, the crew decided to divert to Cubi Point. LT Gant leveled the aircraft at 10,000 feet and headed for the divert field.

While preparing for a single-engine field landing, the crew discovered that there was 6500 pounds of fuel in the wing that could not be dumped or transferred. Aircraft gross weight, however, was 40,000 pounds, well within the maximum field arrestment weight limitation. LTJG Bond broadcast their intentions to Cubi tower, and the *Intruder* was cleared for a straight-in approach and landing on Runway 07.

LT Gant reduced power on the port engine to approximately 80 percent and commenced a descent. While leveling at 3000 feet for dirty-up, still 2-3 miles from the end of the runway, he discovered that the port throttle was jammed at 82 percent and could not be physically moved.

Instantly evaluating his airspeed, altitude, and distance remaining, LT Gant judged that the *Intruder* could successfully "glide" the remaining distance to the runway. LTJG Bond informed Tower that the "underpowered" A-6 would be making an arrested landing.

A successful field arrestment followed.

LT Gant and LTJG Bond, through expert crew coordination and by exercising cool-headed professional judgment and airmanship, mastered a potentially disastrous situation.

Well Done!

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the LSO forever an asset

By CDR James H. Flatley, III

IN 1959, a nucleus of seasoned aviators, not all having an LSO background but each with an outstanding reputation of performance in the carrier aviation environment, was assigned to our air wings to both supplement and assume platform duties from that vanishing breed of very professional and colorful LSOs who gained their reputation on straight decks with paddles and lighted suits. From this nucleus, there sprang into being a new generation of LSOs capable of not only controlling the pattern and performance around the ship, but of also effectively demonstrating from the cockpit what they preach on the platform.

You will recognize them today as your air wing LSOs. Their arrival on the scene was almost coincidental with the initiation of the replacement training program. The marriage of these two programs and the attendant sophistication of many of our visual landing aids had an immediate and profound impact on carrier aviation safety through the early 1960s; the Navy's gross and

uncalculated attempt to transition to the jet era was salvaged. For those unfamiliar with the events of that era, carrier aviation's attempt to transition from prop to first generation jets and almost immediately to high wing loading jets was disastrous, particularly in the carrier recovery phase of flight. In fact, it was a CNO study of this particular situation that resulted in the institution of our RAG concept and revitalization of our LSO community.

The uniqueness of this new bunch of LSOs, as with their successors today, stems from the fact that they were more than just LSOs. They were operationally proficient pilots, who, when not on the platform, were crossing the ramp day and night with the rest of the air wing – more often than not qualified in several types of aircraft. The attention and respect they garnered from the rest of the air wing was earned.

This program perpetuated itself until the midsixties when, for various reasons (pilot retention, personnel assignment policy, lack of squadron level command attention in LSO trainee assignments, the aircrew drain to Southeast Asia, and loss of appreciation for these many factors in our type commander LSO billets and management of our LSO assets), it lost its impetus and continuity. This regression was immediately reflected by a sharp upturn in our carrier landing accident rate. The impact was so significant, in fact, that CNO, through the Office of Naval Research, actually contracted a civilian agency to analyze how and why we had gone astray and to recommend solutions – a shameful testimony to our inability to communicate within our own small, carrier aviation community. The study was, however, effective and helped to get us back on track.

Incomprehensible to this commander, one of our basic problems in this area remains with us and is almost

blatantly obvious in any unit where the weakness exists: the failure of our commanding officers to designate their *most* competent junior aviators as LSO trainees – modified only by the factor that it is preferable they be volunteers. This factor being easily influenced if the following proven rationale is presented to the selectees:

If a tangible value could be attached to the benefits derived by an LSO trainee during his first deployment, it might be generalized that he has probably gained at least another full deployment's worth of appreciation and exposure to carrier operations as compared to his peers who spend their collateral duty and free time in the shops, readyrooms, and rack. His very personal exposure to Primary, Air Ops, CCA, arresting gear, the Bridge, the interrelationships of all of these, their capabilities and deficiencies, and the overall reliability of shipboard systems becomes a lasting and invaluable part of his

professional makeup. Such an individual must possess a fine mind, maturity, and the motivation to relate to all of these factors.

Furthermore, it is vitally essential that our first tour LSOs today be selected possessing the personality and intuitiveness to judge the character of more than 100 human beings (his fellow aviators), and be capable of leaving each in a positive frame of mind after constructively criticizing them day after day, months on end. In the course of a deployment, the LSO's daily exposure to CAG, each and all of the squadron COs, their methods of leadership, and their attitude and philosophies on carrier aviation provides an education of incalculable value to his career.

On top of all this, the trainee is the prospective squadron LSO and, as such, must have the ability to quickly establish his own professional reputation and airmanship ability within the squadron and air wing if he hopes to gain the respect and attention necessary to carry out his responsibilities effectively on the succeeding deployment. It has become a repeatedly substantiated fact that trainees, properly nominated, experience level notwithstanding, rank in the top 10 percent of their squadrons in overall carrier performance by the end of their first deployment.

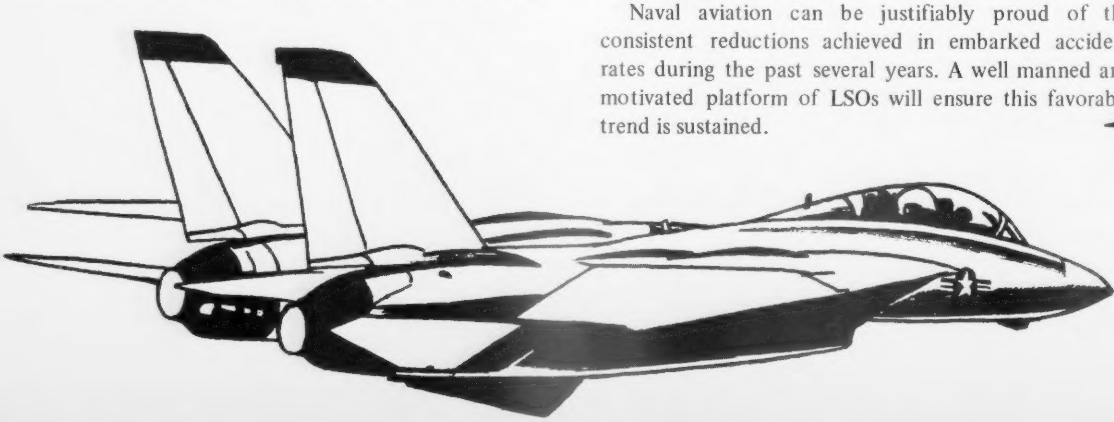
In today's squadron organizational makeup, there is no other JO billet approaching this one in terms of responsibility, accountability, and, of course, satisfaction for a job well done. In recent times, never has a JO billet been so career-enhancing and a sure road to command opportunity – the reward for laying it on the line repeatedly, personal sacrifice (many dark, cold, and lonely nights of FMLP), and significant contributions to the team effort.

The commanding officer who fails to take all these factors into consideration with his candidates before deciding on his new LSO trainee is not only doing naval aviation a disservice, but his most capable JO an injustice. Thankfully, our aviation training pipeline is producing such a wealth of talented and capable aviators these days that our COs are forced to choose between rather than seek out the type of trainees we are looking for. In a few cases, however, this advantage is not being capitalized upon.

From this point on, the continued success of naval aviation's LSO program rests with our type commander LSO managers. Their relationship with the air wing and RAG LSOs must be close because through these individuals the type commander LSO gains a firsthand knowledge of his squadron LSOs and LSO trainees. Armed with this appreciation of individual performance and potential, he is BUPERS' prime point of contact when it comes time to nominate a fleet LSO for a shore-duty LSO billet, be it RAG, Training Command, or RDT&E. In like manner, the type commander LSO submits air wing staff LSO nominations to BUPERS. Our AIRLANT and AIRPAC communities are presently functioning very effectively in this respect. We shouldn't let it slip away.

One continuing weakness in the administrative management of our squadron LSOs is the significance attached to an LSO's initial qualification letter. BUPERS and many others have historically interpreted said letter in an individual's jacket as a green light for assignment to key LSO shore duty assignments. In reality, all this initial letter usually means, or should mean, is that the individual in question is conditionally qualified on the ship and in the air wing denoted. Justifiably, it has become a motivating tool used by our air wing LSOs – the wing LSO knowing he can never legally leave his conditionally qualified squadron LSO in charge (all by himself) on the platform until a letter is in his jacket. In other words, it's the old imponderable, you can't be an LSO unless you are one. It should be no different from the philosophy behind letting our aviators solo early in training; until they do, there is a question of self-confidence on both sides. From that point on, we continue to train and monitor until one wins his wings. Likewise, a final letter of unconditional qualification should be submitted as the squadron LSO's PRD approaches to reflect a consensus of the opinions of the squadron CO, the CAG LSO, and the type commander LSO as to that particular individual's ability to assume the responsibility of a key LSO billet ashore.

Naval aviation can be justifiably proud of the consistent reductions achieved in embarked accident rates during the past several years. A well manned and motivated platform of LSOs will ensure this favorable trend is sustained.



FY-74 CNO SAFETY AWARD WINNERS

CNO "Readiness Through Safety" Award
Naval Air Training Command

COMNAVAIRLANT
**VS-24*
**HC-6*
**VRF-31*/VR-1
VF-74
VA-82
VA-42
VP-30
HS-5
VAW-124
RVAH-6
VF-101 Det Key West

CNATRA
VT-2
HT-8
VT-29
VT-26
VT-21

COMNAVAIRPAC
**VF-143*
VA-95
VA-215
VS-37
VP-50
VAQ-133
VAW-111
HSL-33
VA-122
VC-7
VX-5

CGFMFLANT
**VMGR-252*
**HMM-261*
VMFA-312
VMO-1

COMNAVAIRESFOR
**HS-74(NAS SOUTH WEYMOUTH)*
VA-304(NAS ALAMEDA)
VF-301(NAS MIRAMAR)
VS-81(NAS NORTH ISLAND)
VR-53(NAS MEMPHIS)
VP-68(NAS PATUXENT RIVER)

CGFMFPAC
**VMAT-102*
HMT-301
VMO-2
VMA-211
VMFA-115

CGMARTC/4th MAW
VMF-351 (NAS ATLANTA)
HMM-764 (MCAS EL TORO

Admiral James H. Flatley Memorial Awards

CVA(I) *USS FORRESTAL CVAII USS CORAL SEA LPH IWO JIMA

**Second Consecutive Award*

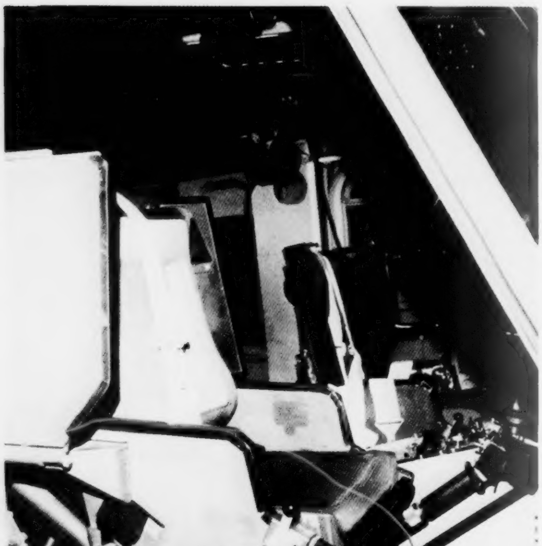
A Crashworthy Armored

THE NAVAL Air Development Center and U.S. Army Aviation Systems Command have successfully completed a joint program to develop and qualify an armored pilot/copilot seat for Navy/Army helicopters. The main objective of the NAVAIRDEVCEN technically managed program was to develop and demonstrate a seat system which would significantly improve crash survivability in helicopters. This has been accomplished through the use of energy attenuating devices which limit the acceleration on the seat bucket and loads applied to the crewman and aircraft floor.

Analysis of helicopter accidents of moderate to severe impact has spotlighted the need for a seat which will adequately protect the occupant. All too often, the seat's inability to limit acceleration or remain structurally intact has caused disabling or fatal injuries to crewmembers. Dynamic tests have shown that brute force methods to retain seats in aircraft can result in crewman exposure to excessively high impact forces, and seat failure and breakaway will definitely reduce his chances of survival. It was apparent that improving the crashworthiness of pilot seat systems would significantly reduce the incidence and severity of helicopter crash injuries.

The key to a crashworthy seat is its ability to manage energy through the process of displacing relative to the aircraft floor. "Stroking" of the seat bucket is set to occur at a load level within human tolerance and below the level at which its floor attachments would fail.

The two photos show the armored bucket and its supporting frame structure. For those familiar with the Army's UH-1 series of helicopters *(and ex-Seawolves – Ed.)*, the seat appears to be the same as the armored seats presently installed in those aircraft. In



Pilot/Copilot Seat

By Marvin Schulman
Naval Air Development Center

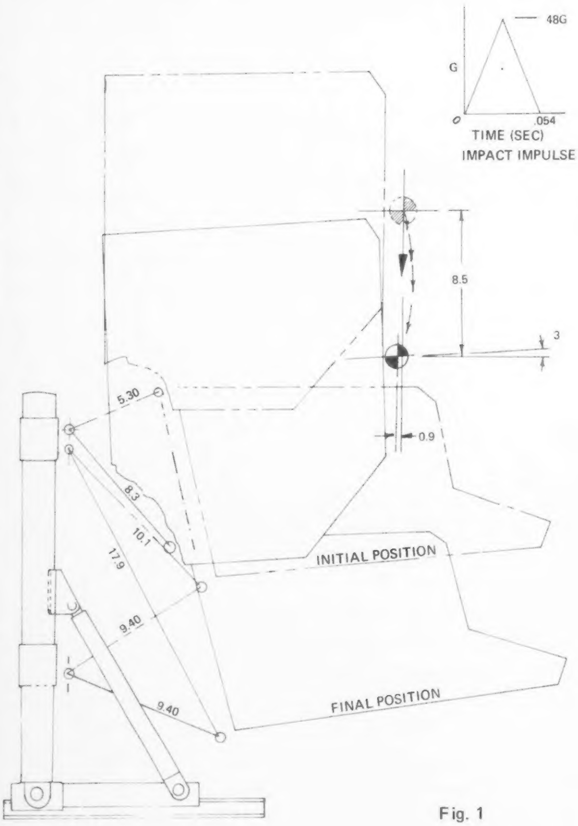


Fig. 1

fact, the armored bucket is identical, but the cushion and support frame are completely different.

The aluminum oxide armored bucket is attached to the upright frame through a system of six energy absorbers called TOR-SHOKS. These are the heart of the crashworthy seat system. Each consists of a single layer coil of wire captured in the annular space between two cylinders. The radial clearance between the concentric cylinders is dimensioned and toleranced so that the wire is squeezed to create the necessary friction force to roll when the two cylinders are loaded with opposing forces.

Each TOR-SHOK was preset to a load at which its inner and outer cylinders would begin to move relative to each other and produce a characteristic square wave load-deflection curve. By attaching the combination of TOR-SHOKS between the frame structure and armored bucket, we can understand how an impact would develop the necessary forces to cause the bucket to move under the control of the inner cylinders away from the frame-attached outer cylinders.

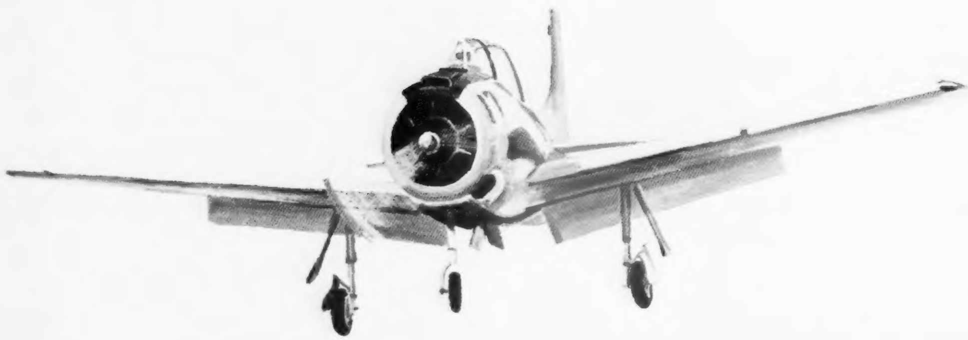
With the array of energy absorbers shown, the bucket can move on any of three axes. More important, its motion pattern is clearly predictable if the impact direction, magnitude, and duration are known. The degree of attenuation is determined by the combined mass of the seat bucket and crewman and the preset loads in the TOR-SHOKS.

A computer program was utilized to optimize the setting of each energy absorber within the 5th and 95th percentile pilot population. It used impact pulses representative of crash pulses, the severity of which is not exceeded in 95 percent of the potentially survivable rotary-wing aircraft accidents. Figure 1 schematically shows how the seat would move under the influence of a vertical impact depicted by the isosceles triangle. In its final position, each of the TOR-SHOKS has rotated, with the upper two stroking. The c.g. of the seat/man system has moved downward 8.5″, reducing the 48G input to 20G at the c.g.

The UH-1 helicopter has been selected as a primary candidate for the seat system since it is still being actively procured by the Army and Navy. Another consideration in its selection was that the low cost, GFE armored bucket presently used in the aircraft could be readily adapted to fit the new support frame. The design of the frame attachments, however, are such that almost any other bucket configuration could be just as easily accommodated.

Proof of the seat's structural integrity and energy attenuation capability has been demonstrated in a series of dynamic crash tests. All required environmental tests have also been successfully completed. Present plans call for the installation of the seat in 24 UH-1N helicopters recently procured by the Navy. A seat system utilizing the support frame and a modified version of the armored bucket has also been designated for the CH-46E Service Life Extension Program.

The following letter,
because of its length,
is presented as a separate article.



WHO'S RESPONSIBLE?

CONUS – This letter relates to a situation that came up last weekend while flying out of a civilian field. I was flying a T-28B, getting my yearly flight requirement, and wished to operate in the vicinity of this particular airport for a few days while conducting orientation hops.

Because I was unfamiliar with the area, I decided to talk to the local approach control and find out where the best place would be to conduct my flights and request radar monitoring. I told the radar people what I wanted and that I would be doing some maneuvering with overhead airwork. It was suggested that I operate to the southeast near some lakes – the same area that the local flight schools use for training. I was also informed that their altitude limitation was 5000 feet.

After takeoff, I contacted radar, was identified, and was given vectors to the suggested operating area. I located the lakes previously indicated and began orienting myself. The weather was clear with at least 20 miles vis, a good day for flying.

On this first hop, I got a little too far to the southeast and was told by Radar that I was too far out and they could no longer paint my aircraft. I flew back toward the field and rechecked my geographic limits so as to ensure positive radar control.

The first couple of hops were uneventful, and I was given several "bogie" targets. On the third hop, while performing an acrobatic maneuver, Radar warned an inbound Army aircraft that I was at his 12 o'clock, 3 miles, and maneuvering. The Army aircraft responded that he had me in sight. Radar asked what my altitude was, and at that time, I was approximately 4000 feet, descending. I leveled at 3000 and made a turn to see if I could pick up the traffic at my 6 o'clock, 5000 feet. I didn't see it.

After several more hops, I was informed that there had been a flight violation filed against me by an Army pilot. Specifically, the violation was performing unauthorized flight maneuvers in and around controlled airspace.

My first reaction was to rush over to find out who controlled the area I was flying in and to determine the "hazard" I had caused the aircraft in question. I felt this matter could be cleared up as soon as the situation was explained to the Army pilot and he understood the precautions taken to keep aircraft separated. After a

lengthy discussion, the flight violation was withdrawn . . . and I am writing this letter to clarify a few points I learned from the incident.

Having spent the last 3 years in a proficiency billet, it could be that I am not as familiar with FAA regulations as I should be. But at the same time, because I have been in proficiency flying so long, I have a tendency to be extra cautious in regard to what I do in the air.

In this case, I felt that by going to approach-departure radar I would gain the safest place to fly and also be under positive radar control, thus keeping myself aware of other traffic. Because this was airspace controlled locally, I thought they could authorize me to perform the type flying I had indicated I would be doing. I thought I had been very specific in that I had said I would be *maneuvering* my aircraft and doing some overhead airwork.

In our discussions later, ATC never realized I would be performing acrobatics. Yet, FAR Part 91 defines acrobatics as any intentional abrupt change of attitude or abrupt abnormal attitude or acceleration not necessary to normal flight. In this regard, ATC knew I was operating within this definition. Radar called my position to other aircraft as a "T-28 performing maneuvers – or maneuvering . . ." which further shows they knew pretty well what I was doing.

I feel my greatest failing was that I, as pilot, never went to a map or enroute chart to see if there were any indicated hazards or other restrictions that I should be aware of. As it turned out, there was an airway going through this area with a MEA of 3000 feet; and even though ATC was maintaining aircraft separation, the authority to perform unauthorized maneuvers did not rest with the local ATC.

Talking with other pilots on this, they *all* indicated they would have handled the situation the same as I. This would indicate a need for clarification. There are certain things ATC is allowed to waiver, such as operating within their area without a radio or IFF, for example, but they cannot authorize the type flying I requested, in or around controlled airspace.

Additionally, it points out the old adage that final responsibility always lies with the pilot. Therefore, blindly accepting the professionalism of others can lead one into problems such as I experienced in this case. Also, if one is going to fly, it is mandatory that he stay abreast of all current regulations.

Name Withheld

(When making arrangements for conducting other than normal operations, make certain the other party knows **exactly** *what you have in mind. Federal Aviation Regulations task the pilot with the responsibility for the operation and safety of the aircraft. – Ed.)*

SAFETY PITCH

The quote below was taken from an article, "Hindsight is Always 20/20," by MAJ Jerry Cox, USAF. Printed in AIRSCOOP, it detailed an inflight fire in an F-4 *Phantom* cockpit.

"So, if you have people who like to fly with sleeves rolled up, gloves and mask off, and visor up, they are looking for trouble. There isn't time to put protection on when everything goes to hell in a hand basket. That's my one safety pitch."

A Letter of Introduction

to Airfield Operations

ALLOW me to introduce myself. My name is Harry R. Veestol, "AV-8er" extraordinaire. I'm new in your neighborhood, so I thought I'd let you know a little about me. When my buddies and I begin to join your traffic pattern, you will hear some strange terms and see some strange sights. Hopefully, this letter will help prepare you for them, so the first time you see me crossing the threshold at 50 knots, you won't be tempted to sound the crash alarm or dive for cover.

Let's go over some of the terminology you'll hear from the *Harriers* in the pattern:

"Tower, Lime 12, request *short takeoff*." What I'm asking for here is a rolling takeoff similar to other conventional aircraft; however, I'll be using thrust vectoring to shorten my takeoff roll. I won't need much runway (anywhere from 500 to 1800 feet, depending on free air temperature, station pressure, and aircraft gross weight), so don't be alarmed if I request an intersection departure at midfield. If I ask for a *rolling vertical takeoff*, it's the same thing, except this time I'll only use 200-300 feet before I leap into the air. Note: You won't see me taking off or landing across your rigged arresting gear because my outrigger tires are small enough to snag the wire. That can ruin my whole day.

"Tower, Lime 12, request *vertical takeoff*." I won't ask for this type of takeoff unless I can use a *clean* concrete or matted area on your airfield. Once you've cleared me, I'll taxi into position, point into the wind,

and run up my engine. Next, I'll smartly lower my exhaust nozzles and lift off to an altitude of 50-100 feet. Then I'll transition to forward flight, either level or in a slight climb. Before you know it, I'm a fast mover again. If I ask for a *pressup*, that means I'd like to do a vertical takeoff, come to a hover, and then land vertically in the same spot.

"Tower, Lime 12, 180, gear down, *stops clear,* for a *slow landing.*" First of all, the "stops clear" call is nothing more than a reminder to the pilot to remove the nozzle lever and throttle mechanical stops prior to the approach. It's an important part of my landing checklist. Secondly, although I requested a slow landing, it will probably look like any other conventional fixed-wing landing from the tower. Touchdown speed will be 100-120 knots, so why do I call it a slow landing? Well, some emergency situations require a conventional landing, which for me is right up around 155 knots! If you watch either a conventional or slow landing closely, you'll notice two significant features which make them a little different from conventional fixed-wing landings:

- I'll fly my final approach a little shallower than the normal 3-degree glide slope you're used to. My landing gear isn't stressed like most Navy/Marine Corps jets.
- After I touch down, you'll notice a rapid deceleration. What I'm doing is rotating my nozzles to the "braking stop" position which allows me to use engine thrust to slow down.

"Tower, Lime 12, 180, gear down, stops clear, *rolling vertical landing* at midfield." This time, I want to make a very slow landing (i.e., anywhere from 10 knots to 80 knots). The approach will look the same as the slow landing until I roll out on final. Now, I'll start slowing

When I'm in the soup, I'm a conventional jet. I'll shoot my TACAN and radar penetrations at 300 knots, slowing to 250 knots to put my gear down. Then I'll fly the GCA pattern at 240 knots, slowing to about 180-200 knots for the final approach. Don't expect me to slow down until I'm visual and about a mile from my intended point of landing. Also, remember my favorite way to land is vertically, so don't be surprised if at three-quarters of a mile or so I level off and fly at 180 knots, 300 feet over the radar touchdown point. All I'm doing is continuing down the runway to land vertically at the other end. (Saves tires!)

A few words on limitations and versatility: If the weather is good, I usually don't bring a lot of fuel back to the pattern with me. My tanks are small enough as it is, and I'm accustomed to planning my missions right

and GCA Officers

By CAPT Bryan O'Connor, USMC
VMA-513

down by vectoring my thrust down and/or forward. I only need a few hundred feet of runway for a rolling vertical, so trust me if I request the departure end of the runway for this one.

"Tower, Lime 12, 180, gear down, stops clear, *vertical landing,* departure end." Now we're talking my language. This is what I'm all about. If your landing surface is free from FOD and of substantial construction, I'll request this type of landing. Again, I'll do all my decelerating in the air, come to a 50/100-foot hover over the landing spot, and let 'er down.

Now, for your GCA controllers, let's backtrack a little. All this stuff about slow speed flying and vertical pattern work applies only to the visual landing pattern.

down to the wire. When I return to base, I usually have enough gas for one waveoff and one or two turns in the delta pattern before I'm emergency low fuel. However, that's where my versatility comes into play. Plain and simple, I don't need your runway to get down safely. I'm very accomplished at landing on the end of the off-duty runway. In a pinch, I can perform a perfectly safe 50-knot rolling, vertical landing on the taxiway, the access road, or even the grass median.

I hope this information about the *Harrier* will serve you well as you prepare for a unique brand of flying at your airfield. I think you'll find that after you've seen and controlled me in the pattern, conventional flight ops will never be the same.

Last Great Hope

FPO, New York — I have for many years been an avid reader of your "Book for Birdmen" and have hopefully learned a lesson or two from those less fortunate than I.

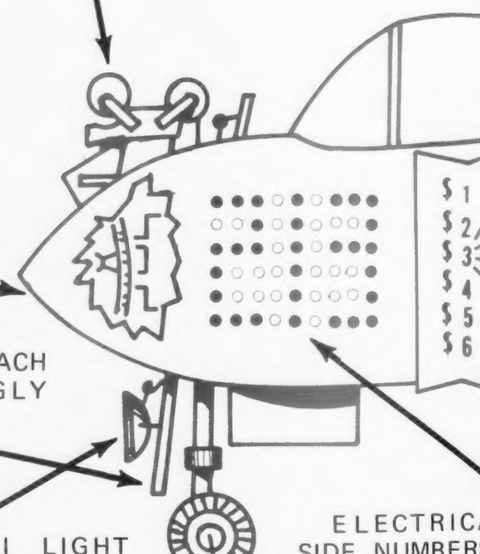
As Training Officer of my squadron, your magazine has proved a valuable aid to "bringing the bacon home" to the mumbling masses that stare at me during those training AOMs.

I have also noticed with some distaste that your "turn-up tabloid" is completely lacking in sympathy for our not so exclusive club of "one-wire catchers" and "hook bouncers." If the truth were out for all to see, it would at once become crystal clear that it is not the "expert aviators" who are at fault, but rather that group of "purposeless plumbers" who man the LSO platform.

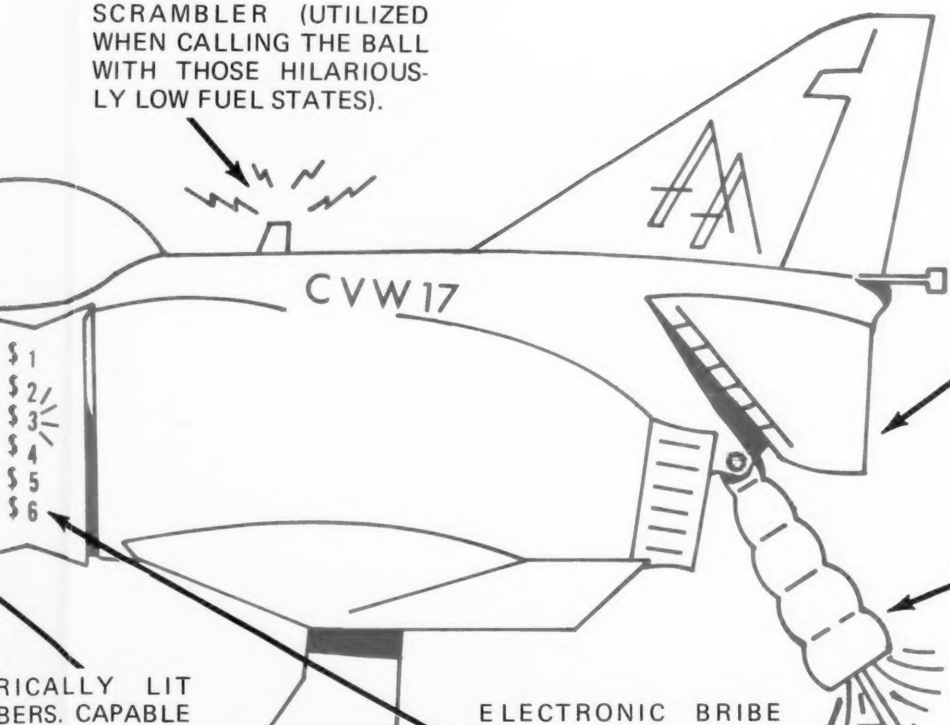
In an attempt to see that justice prevails, I am sending you an advance copy of the airframes change being proposed to McDonnell Douglas for our F-4Js. I would be forever grateful if you would publish this last great hope for deck spotters everywhere.

LT Dennis J. Fitzgerald
The Fighting Bedevilers
of VF-74
USS FORRESTAL
(CVA-59)

The LSO-



-Proof Aircraft



. . . and IAW our policy of equal time, see pg. 6. — Ed.

SO YOU'RE GOING TO FLY THE VIKING

By LCDR R. L. Wilson
ASO VS-41

Advice and Technical Assistance:
Lyle H. Schaefer
Lockheed Engineering Test Pilot

THIS bird, like its Nordic namesake, is a steady, versatile navigator of the seas. Just as the Vikings of old were noted for their knowledge of the sea and the ships they sailed, your key to successful transition from the low and slow crowd to the jet set will depend on what you know about this new environment and your new ship.

Versatility. Few aircraft in the Navy's inventory have mission requirements that necessitate such a wide range of performance as does the S-3A. It stands, then, that the pilots' knowledge of the full spectrum of flight, including high altitude/high speed, relatively high G, and inverted characteristics, must be understood. It's time to drag out "aerodynamics for Naval Aviators" again and look at the mysteries of flight in rarefied air.

I had the pleasure of being in the first VS-41 factory training class held at Lockheed's Burbank plant. This gave me the opportunity to learn to fly this bird from the gents who conceived and gave birth to this magnificent machine. It was a pleasure to rub elbows with these enthusiastic flight instructors and maintenance men. Their enthusiasm was contagious, and I would like to relate my first impression of this craft.

Up and Away. I have never flown an airplane that felt more like it wanted to fly. Eighteen thousand pounds of thrust from those big fans make for fast acceleration on the runway and a short takeoff distance. Because of the fuselage-mounted gear, you have to pay attention to wing position on takeoff, but the powerful aileron/spoiler combination allows you to "fly" the airplane during the takeoff roll. Nosewheel steering aids in directional control even in the stiffest crosswind, and she flys away at 105 knots after 1300 feet of ground roll.

Then things start happening fast. If you leave takeoff power on the aircraft, you'll climb and accelerate briskly, especially at light gross weights. The reason is fairly obvious. At full power, a large excess of engine thrust converts to increased airspeed, altitude, or both. So, it's best to reduce power to maintain a comfortable rate of climb. This gives the air controllers (and the pilot) time to catch up with the airplane. With the *Viking* cleaned up and pointed skyward, your first impression is good and getting better.

The flight control system feels smooth as you move the stick, and it rolls like a high performance low inertia airplane. One of the design specs was extremely good roll performance at approach speeds. So, at higher speeds, roll rate gets into the high performance class. *Caution* – that max roll rate at high speed creates some structural hazards by imposing positive G loading – particularly if you've already loaded her up in a tight turn or a hard pullout. She's stressed for 3.5 positive G, but if you fly near the limit and introduce a rapid roll, you'll overstress this bird. But for you S-2 or P-3 types who are frustrated fighter pilots, you'll find the S-3 does aileron rolls, wingovers, and barrel rolls to a fare-thee-well.

Continued

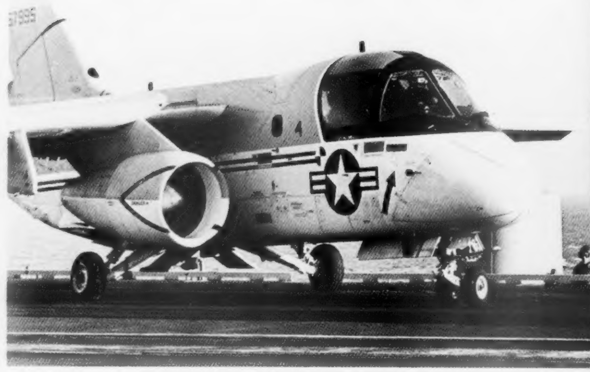
Stalls. One of the unique qualities of the *Viking* is its docile stall characteristics. After all this talk about modern jet performance, you might expect a full stall to be a fairly sweaty business. Not so. Lockheed spent many flight test hours tailoring stall strips (small, right-angle metal strips added to the wing leading edge) to trigger separation at the wing root at high angles of attack.

The S-3A stall characteristics are essentially the same flaps up or down. The only factor that radically changes the characteristics is use of full power. To stall the aircraft, you merely raise the nose 10-15 degrees, power back, and let it decelerate. At approximately 20 units AOA, you get the natural stall warning: a mild airframe buffet, increasing in intensity as you approach stall. With power set for level flight or at idle, the nose attitude at stall is not high.

A good cue of impending stall is the increasing stick force required to hold the nose up. The stall is noted when the wing finally stalls enough to cause the nose to drop through, sometimes with a mild roll in one direction or another. If power is applied as the nose drops through, recovery is usually complete in 200 to 300 feet. The aircraft is very stable at stall, and complete lateral control is available well into the stall. Even at extremely high AOAs, the aircraft has no tendency to spin, slice, yaw, or depart.

Rapid Descent. A *Viking* characteristic that will amaze even the fighter and attack types is its ability to perform a controlled rapid descent. A full speed brake, idle descent resembles atmosphere reentry in a spaceship. The original design requirement specified descent from 35,000 feet to sea level in 2 minutes. Even by limiting pitch attitude to 30 degrees nose down, descent rate exceeds 12,000 fpm. The speed brakes need not be fully out, but can be extended incrementally from zero to 45 degrees, so you can adjust your rate of descent as desired during an instrument penetration.

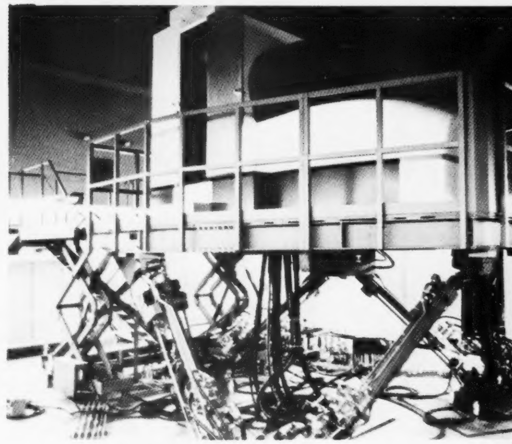
Dash. The S-3A flies well slow or fast, but a word of caution to those who will be tempted to push the aircraft to its upper limits. At altitudes above 8000 feet, the S-3A's limit airspeed (450 knots) is surpassed by its mach limit (.79 IMN). The aircraft was designed with a fat wing to give greatest stability at ASW working speeds (160-250 KIAS) and at landing speeds (100 KIAS at 34,366 pounds gross weight). This fat wing (thick airfoil) tends to produce a normal shock wave on the upper wing surface at transonic speeds (.75 IMN). Airflow separation occurs aft of the shock wave which is felt in the cockpit as a high frequency buffet on the airframe. If high G is applied while at or near limit mach, the buffet increases in intensity and frequency and proves very uncomfortable for the crew.



Landing. Landing this machine is a simple matter of getting set up at the 180 degree position and flying a constant donut AOA to touchdown. No flare is required because the airframe is designed for a 22.6 fpm maximum touchdown sink rate. At optimum AOA (15 units), the pilot has the same stall margin regardless of flap configuration or gross weight, so you don't have to look up an approach speed for every pass. Single-engine approaches are really simple as compared to the old "stoof." Except for "takeoff" flaps (70 percent) vice "land" flaps (100 percent), the single-engine pattern and procedures are very similar to the two-engine approach and only slightly faster. Because drag is very low in the approach configuration, power requirement is also very low, so little rudder is needed. That will please all you "one leg shorter than the other" stoof drivers who practice single engines.

Put It All Together. The overall impression one gets flying the *Viking* is that he is controlling the aircraft at all times instead of just being along for the ride. This is largely because of the quick and powerful response to small stick inputs and the large amount of thrust available at your fingertips.

Overall, my impression and the impression of all who have flown the S-3 has been consistent: the *Viking* not only has tremendous capabilities to hunt and kill submarines, but also it's a pilot's airplane and a real pleasure to fly. Anti-Submarine Squadron FORTY-ONE has spent the last year developing a flight and maintenance syllabus that will challenge the enlisted maintenance men, the jet nugget pilot or NFO, as well as VS second tour crewmen. Our first mission is to retread the existing VS squadrons on the east and west coasts, and then some time in July 1975, we'll receive a steady input from the jet pipeline. If you can get a cross-country training flight to San Diego, come on over to the "*Viking* Center" and we'll show you around.




BEWARE OF
BLAST

"The Last Run of Flight Nine One Five," in the APR '74 APPROACH, brought feedback from a reader who calls attention to an article in APPROACH some 14 years ago. Although VOR approaches are no longer the primary recovery procedure for Fleet type aircraft and few T-33 aircraft remain in naval service, the article reprinted here is still applicable in today's aircraft. It reveals how pilots are still frequently led into a fatal trap, simply because . . .

The Eyes Don't Have It!

"INCREDIBLE – it exceeds the bounds of an extremely flexible imagination for an aircraft with two pilots aboard (one flying hooded, the other as safety observer) to be descended into the ground, while flying VFR at night." . . . "The determination of high or low, in the proper perspective, isn't difficult for the average jock; this cannot be denied. So, the safety observer should have determined that the aircraft was low, had his attention not been distracted."

These two excerpts were quoted, word for word, from an article in a USAF publication dealing with the fact that four T-33 aircraft were flown into the ground last year. This type accident occurs every now and then and is forgotten almost immediately. After all, what can you say when a normally functioning aircraft is destroyed with no apparent reason? After reading this article, you tend to think, "What a meatball!" and head for the lounge to get another cup of Joe.

I am familiar with one of these accidents and would like to single it out for further discussion. It merits special consideration, since it contains a lesson we should have learned long ago.

The T-33 involved was flown into the ground during a practice VOR approach on a clear night with two pilots aboard, one hooded and the other observing. The hooded pilot inadvertently lost 1000 feet during the turn after low cone without being noticed by either him or the safety observer. As they came out of the turn, he leveled off at what both pilots believed to be the low cone altitude and began the descent to minimum altitude for the low approach. After 300 feet of descent, the aircraft crashed 7 miles short of the runway.

The accident was duly investigated. Cause factors were assessed, and recommendations made. One aspect of the accident, however, was not explored fully. The real cause factor of this accident and others like it can be determined from the answer to one question – *Why didn't the safety observer, even without reference to his altimeter, see that he was low and take corrective action?*

I maintain that the pilot in the front seat was led into a trap – that he was trapped by his eyes! Why didn't a warning bell ring when he became dangerously low? Why didn't his eyes trigger a danger signal before impact? The fact is, they couldn't. They could discern nothing different from what they had become accustomed to since coming out of the penetration turn. As a matter of fact, approach, threshold, and runway lights were in sight at impact. The pilot had the field in sight all the way.

Before I go into my pitch, a little background on the field and approach is in order, so you will better understand the bait used in this trap.

The VOR is almost 10 nautical miles from the runway, and the terrain, while smooth and rolling, is about 100 feet higher than field elevation.

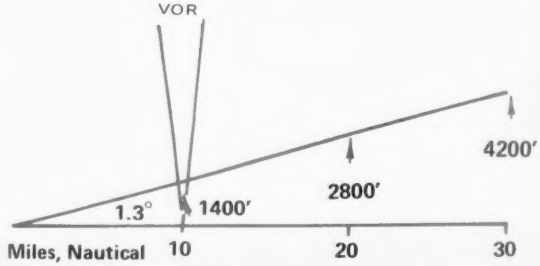
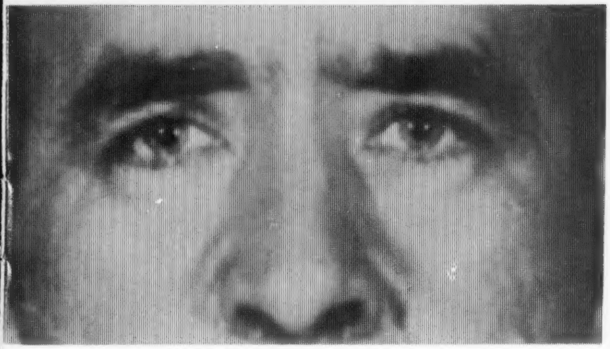


Fig. 1 (Not to Scale)



There are no lights on the ground in the area between the VOR and the field to give a pilot the "proper perspective" he is supposed to have.

The approach end of the runway is lower than the midpoint. This would thus give the impression of being higher than you are, because of the tilted plane view presented to your eye during approach.

As mentioned before, approach, threshold, and runway lights are plainly visible from ground level at the crash site.

The key to this whole business lies in the fact that throughout this type of approach, the angle at which the pilot is observing the runway is extremely small – on the order of one degree. Let's slip over to Fig. 1 and develop this a little further.

You will note that there is 1400 feet terrain clearance at VOR, and you will be looking down at the runway at an angle of 1.3 degrees. For this approach, you pass low cone at 1400 feet, then descend to 800 feet, minimum altitude.

Let's assume that you were level at 1400 feet, 20 miles out. Inspection of the diagram will show that your angular view of the field will increase to low cone, decrease as you descend to minimum altitude, then increase as you drive on in for a low approach.

Figure 2 is similar to Fig. 1, except that the angle intercepts a point 800 feet above the terrain at 7 miles.

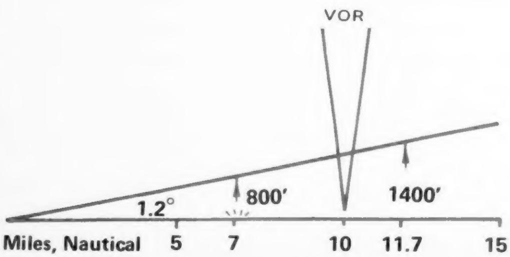


Fig. 2 (Not to Scale)

Note that the plane view of the runway will be just about what you had at low cone and is the same as what you saw at 11.7 nautical miles. The crash occurred at approximately 7 miles, at an altitude of 100 feet above the field elevation. Measured in feet, the altitude discrepancy was enormous, while the angular difference was only about one degree!

In this case, the pilot saw nothing out of the ordinary. His view of the field was never very good. Moreover, the difference between .2 and 1.2 degrees is not easily discernible to the naked eye. I am aware that all who read this understand the very basic concept described and presented graphically by Figs. 1 and 2. But how many think of these things during an approach? How many consciously think of the profile being flown and recognize its hazards?

There are some who don't. Rather, I should say didn't . . . including myself. At this field, there are at least two pilots who were dangerously low when flying this approach and didn't know it. They were saved because they maintained terrain clearance until close enough to the field to use the city lights as an additional reference. Both took control of the aircraft from the pilot under the hood and climbed out of danger; neither pilot involved had been paying much attention to his altimeter. After all, they could see the field; it was a clear night; there was a man at the gages. Why worry?

So far, all my remarks have been directed toward a night VOR approach in VFR conditions. How about a straight-in landing under the same conditions, or an approach (instrument or otherwise) with the visibility restricted by haze or low scud when the field is visible? All of these are similar in a way, and all present a hazard to the unwary. This hazard can be eliminated only by paying strict attention to the altimeter until the approach has progressed to a point less than 3 miles from the field. At this time, the rapidly changing angular view of the field will permit a more accurate height determination when combined with a knowledge of the altitude at which final approach was started for a visual landing.

In conclusion, here are two important points to remember when filing to or flying out of any field on a clear night:

- Use extra caution during any approach when the navaid is more than 7 miles from the field. The small angles encountered when looking at the field may trick you into an undershoot many miles short.
- When flying over dark terrain or water, your altimeter is the only accurate means of determining height. Be suspicious until you are very near the field. Don't just glance at the altimeter – *read it.*

USAF "Interceptor"

By LT C. R. Saffell
VAW-122

THE WEATHER at our island destination was forecast for 2500 broken, 7 miles. That sounds like no sweat for an E-2B and a CAPC with 1500 total hours and 850 in type. My copilot was well experienced and was going to fly left seat.

Our mission was to ferry our tired E-2 into the beach for some critically needed maintenance and return to ship the next day. Because of the high tempo of operations and the usual parts hassle that plagues E-2s, our backend equipment was less than complete, and the pilot's VGI was missing. There were no VGIs available on the ship or anywhere else.

After misgivings about the hole in the pilot's instrument panel and more direct briefings on destination weather, I decided the flight could be safely made. VFR would be maintained at all times.

An extensive brief was conducted giving special attention to emergency procedures aimed at my two noncrewmember passengers. These passengers were two mechs who were to perform the maintenance on our machine once we arrived on the beach. A flight tech was also aboard to help out with the radios and act as a qualified man in the CIC compartment.

Start and launch were normal, with special attention given to the alignment of our INS, as its platform is used for the copilot's VGI. We climbed to 15,500 feet and motored in toward our island destination. Both the copilot and I were very familiar with our destination since we had flown there on several detachments. The terrain is very mountainous all around the field which

explains the MEA of 9100 feet. Our plan was to continue in high to the northern side of the island and let down VFR over the water and slip in under the weather.

I contacted destination tower, stated that we were entering their TCA, and requested clearance. The foreign controller requested that I call again at 25 miles DME from destination TACAN.

Looking to the north, the weather looked as grim as it did to the west. There went our plans for slipping in under the weather. From my southern approach, there was nothing but rock – mountains jutting through the overcast.

At 25 miles, I attempted to contact the tower again. I used all four of our UHF radios and every frequency they had including Guard. No joy. The next thing I knew, we were IFR. I contacted the local GCI site on Guard, and he relayed from the tower that we were cleared for the TACAN approach. Since I was only a few miles from the IAF, I continued on the shortest route out of this situation.

I was now flying the aircraft from the right seat with our only VGI. I entered depicted holding at the IAF and began a left-descending turn in the holding pattern to get down to commencement altitude. I passed this fact to the GCI site for relay to the tower.

I was in a 25-degree angle-of-bank turn with 2000 fpm descent established when, out of the corner of my eye, I noticed a light on the master caution panel. My heart went to my throat as the VGI rolled to 90 degrees angle-of-bank to the right and the "off" flag appeared. My BDHI began to spin along with my instrument scan. The light on the caution panel said "INS."

How does the old fighter saying go? "There I was, flat on my back at 15,000 feet . . . " Well, the next thing I knew, I was IFR, partial panel, with my E-2 in an unusual attitude. I had no idea what angle-of-bank we had reached. The VSI registered a 6000 fpm descent.

I finally got my eyes off the dead VGI and ignored the spinning BDHI. I rolled the wings back to the right and saw the turn needle go from pegged left to pegged right. My copilot jumped into the situation and backed me up on the gages (needle/ball). To add to our grief, we were encountering light turbulence, and this was bouncing the turn needle from side to side.

After a few nose-high to nose-low maneuvers and a few more wing gyrations, I felt that we were once again in control of the aircraft. When what we assumed to be straight and level was established (our turn needle was still bouncing from near full right to full left due to the turbulence), I commenced a climb and a very shallow turn back to the area where we were last VFR.

There are not many E-2/C-2 types that would classify the *Hummer* as an acceptable airplane for partial panel (especially when you start from an unusual attitude). So, VFR was our primary quest. I attempted to contact the GCI site again, but no joy. I broadcast my intentions on Guard and even tried to talk to one of our other *Hummers*, hoping he could at least give me flight following. We were squawking emergency on the IFF, but doubted if anyone was receiving it.

After 10 minutes of semistraight wings and climbing, we were between layers at 21,000. Still no communications.

Finally, I switched back to our destination's tower frequency and was able to contact an S-2 that was heading for our destination. It was great to hear a friendly voice. The S-2 stated that he could hear all our transmissions and that tower was down to one radio of low power. Our friendly *Stoof* was north of the field below the 1200-foot overcast. I received my first destination weather at this time – 1200 overcast, 2 miles in rain.

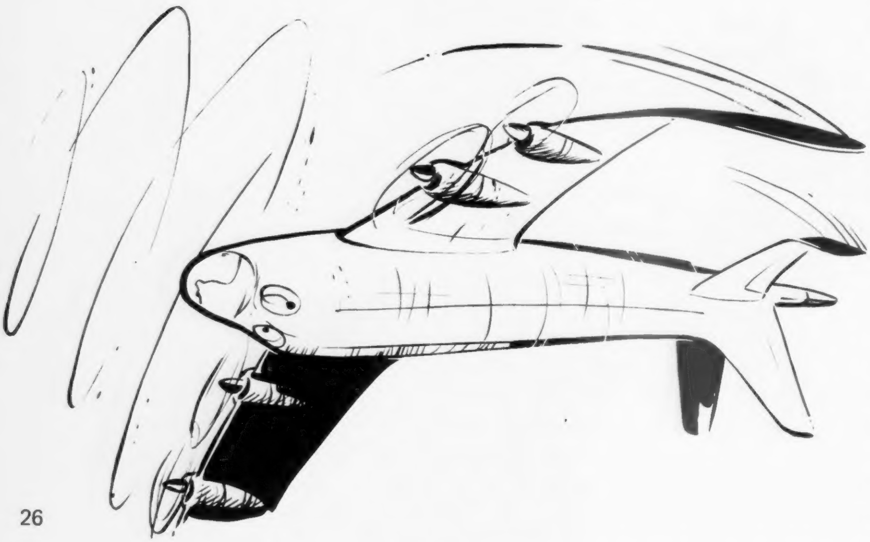
The S-2 stayed airborne north of the field as a communications link and morale booster. We continued well north of the island and began a letdown to a "fisherman" approach. By this time, we had another INS alignment in progress over the water at 1200 feet. The TACAN was useless at this altitude, so we used an ADF cut on the airborne *Tracker* to bring us to Homeplate. The *Stoof* pilots remarked on how unusual it was for an S-2 to steer a *Hummer*. We didn't laugh, but promised a case of beer to the crew. A normal field landing followed.

Two ashen-faced *Hummer* pilots emerged from the cockpit mumbling, "What if?" and "I'll never do it again!" We gathered up the rest of our pale crew and departed for the local pub to celebrate the first day of the rest of our lives.

(This well-written article plus various recent mishap reports continue to underscore the requirement for improved power and reference sources for pilot/copilot attitude indicators in E-2B aircraft. E-2B AFC 179, presently in prototype and Fleet evaluation, provides for replacement of present pilot/copilot VGIs and installation of the ASN-50 reference system. The ASN-50, coupled with the present ASN-36 INS system, provides limited cross-selectability of the spatial reference systems for both VGIs. It is considered that AFC-179 may provide the solution to the requirement for alternate reference sources, provided modification is made to incorporate automatic switching of reference platform during a failure mode and that auto-switch be annunciated.

NAVAIRSYSCOMHQ is also investigating the feasibility of placing a third, self-contained gyro in the E-2B/C cockpit. – Ed.)

Anymouse



We all know that propwash and wake turbulence can sometimes reach out and shake a pilot's tree, but how 'bout rotor wash? It's hairy, too.

Close Call

WHILE in the bounce pattern, an incident occurred that made me realize that rotor heads can wreak havoc with a 100,000-pound P-3 just by pointing their rotor wash in the wrong direction at the wrong time.

As an IP (instructor pilot) in the RAG, I was in the right seat, and my student in the left. We were on an early-stage fam syllabus flight shooting touch-and-go's to Runway 6. At the 180, I noticed a CH-53 making approaches to a hover in the grassy area alongside Runway 6 and observed that his pattern was taking him quite close to the threshold. To avoid crossing over the runway itself, he was banking hard left.

When our P-3 rolled out on final, the helicopter had just completed one of these hard left banks when I happened to think about the possibility of his rotor wash affecting us. We had a slight left wing down attitude to correct for a small overshoot, and I had decided that my apprehension about rotor wash was unwarranted. *Then it happened!*

At about 75 feet over the runway, we suddenly found ourselves wrapped up in a 25-degree left bank. (I just glanced and couldn't read the angle exactly.) My F/E let out a shout, and my student and I both muscled in max right aileron as I crammed the throttles to the firewall.

It seemed like an eternity before there was any response, but we finally regained control, got wings level, and continued our go-around. I sincerely feel that had I not been anticipating trouble, we would have been the first P-3 crew to attempt cartwheels down the duty.

The helo pilot shouldn't have been working that close to the duty and shouldn't have directed his rotor wash across the threshold. What would he have done to an A-4, a T-28, or T-39? The tower should have been alert for the same thing and directed the helo pilot to avoid the approach end. All fixed-wing pilots should be aware that rotor heads can throw a "gotcha" your way, even without presenting a collision threat.

Rightsideupmouse

P.S. Because of this "gotcha," Ops has banned all CH-53 operations close to the approach end of Runway 6 when it's the duty runway.

Every helicopter pilot in the world has been advised, time and again, to avoid duty runways, parked aircraft, and people by at least 200 feet. They know their rotor wash and those rotor tip vortices are nothing but dangerous.

What kind of traffic control was being exercised by tower personnel? Zilch! It is inconceivable that helo operations would be authorized anywhere near the threshold of the duty. The place for such ops is an area far from any active runway or taxiway.

The purpose of Anymouse (anonymous) Reports is to help prevent or overcome dangerous situations. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. These reports need not be signed. Self-mailing forms for writing Anymouse Reports are available in readyrooms and line shacks. All reports are considered for appropriate action.

REPORT AN INCIDENT
PREVENT AN ACCIDENT

Wants Warning

WHILE an ordnanceman was connecting an explosive cartridge to a triple ejector rack, an RA-5C from a sister carrier made a high-speed, low-level afterburner pass down the port side of the ship. The noise scared the ordnanceman so bad that he jumped violently and hit his head on the aircraft under which he was working. Contact with the aircraft split his cranial protective helmet at the base of his skull, but he was uninjured.

Consider what could have happened had an ordnance crew been in the final steps of hoisting a missile or bomb! We like to see high-speed, low-level passes as much as anyone else, but how about a little warning?

Ordnancemouse

(Almost) Ready to Roll

A SPOT check of squadron aircraft revealed the need for replacing some pitot covers. A man was assigned to obtain replacement covers and install same upon completion.

Meanwhile, one of the aircraft for which new covers were being made was assigned an operational mission. The crew arrived for its usual preflight and preparation. The flight engineer removed the old pitot covers as a normal part of his preflight, and one of the pilots completed his exterior preflight – noting the pitot covers had been removed.

While ground maintenance personnel were working off a preflight radar gripe, the newly fabricated pitot covers were brought out to the aircraft and installed.

The PPC returned to the aircraft to advise the crew of a one-hour delay in takeoff. He approached the aircraft from the side and did not notice the new pitot covers installed, especially since he had already conducted his exterior preflight.

After the radar maintenance was completed, the ground maintenance personnel secured the radome and advised the crew. At no time were pitot covers mentioned.

The crew briefed for the flight and prepared to start engines. At no time during the start sequence did the lineman give any indication that he saw or was aware of the pitot covers.

The aircraft taxied out and subsequently received takeoff clearance. Down the runway on the roll, no airspeed was noted on either pilot's indicator. Abort!

The aircraft returned to the line where the newly installed pitot covers were discovered. The covers were removed, and the aircraft completed its mission without further incident.

Points to Consider:

- The aircraft had been properly preflighted.
- The individual assigned to have the new pitot covers fabricated and installed did as he was instructed. He did not realize that the aircraft was assigned a mission and had been preflighted. He also did not tell anyone that the new covers had been installed.
- Ground maintenance personnel were in a bit of a hurry and did not notice the newly installed covers.
- The lineman apparently did not notice the pitot covers.
- The pitot covers did not have red flags attached.

Lessons Learned:

- One good preflight deserves another, especially when work is done subsequent to preflight and when delays are experienced. Another look just prior to engine start would have prevented this embarrassing situation.
- Personnel should always advise maintenance control when something is replaced, removed, or added to an aircraft.
- All personnel, including ground maintenance, should be alert for circumstances which indicate departure from standard procedure, e.g., pitot covers still in place while crew is briefing and preparing to start engines.
- Linemen are the last inspectors (checkers) of the aircraft prior to its departure from the line area.
- Once the new pitot covers were installed, the job was not complete. Had flags been attached, attention might have been drawn to the covers prior to taxi.

Pitotmouse

COMNAVAIRPAC msg 072010 MAR addresses . . .

CV/CVA
Helicopter Safety

FROM time to time, preventable helicopter mishaps and near mishaps occur as a result of misunderstandings concerning helo limitations. In many of these instances, helicopters were launched/recovered outside the safe operating parameters which have been specifically delineated to prevent such occurrences.

To eliminate these misunderstandings, the following is reiterated:

- Launch and recovery of helos during night or instrument conditions (lack of visible horizon for transition to forward flight) require added considerations compared to day, VFR requirements.
- Helicopter instrumentation is inadequate to permit precise hovering or slow speed flight relative to a moving ship without visual reference. Consequently, deck spotting for night or instrument launches is critical. Such launches must be made with the helo's nose oriented parallel to the centerline of the angle or axial deck and with sufficient deck space to permit the pilot to lift into a hover and transition to forward flight with adequate visual reference.
- Night or instrument recoveries which require the helo to land down the throat or athwartship into confined areas are unduly hazardous and must be avoided.

The power required for helicopter launch/recovery is a function of weight, density altitude, and wind across the deck. A typical no-wind hover requires almost 100 percent of the helo's power available, and the transition to forward flight requires an additional increase in power until the helicopter exceeds 15-20 knots airspeed.

By launching and recovering the helo when the relative wind is within 10 degrees of the helo's nose, power requirements are decreased, and optimum safety is assured for launch and recovery. As winds move toward a position off the helo's beam, they reduce tail rotor effectiveness and thereby decrease control responsiveness and increase power required.

Published NATOPS wind parameters assist in safely establishing the helicopter in forward flight by permitting it to attain single-engine airspeed more quickly while reducing power requirements. To provide winds that are not within NATOPS parameters for helos is no more acceptable than launching fixed-wing aircraft outside catapult or wind limits.

To prevent the recurrence of preventable helicopter mishaps caused by misunderstanding, the following is directed:

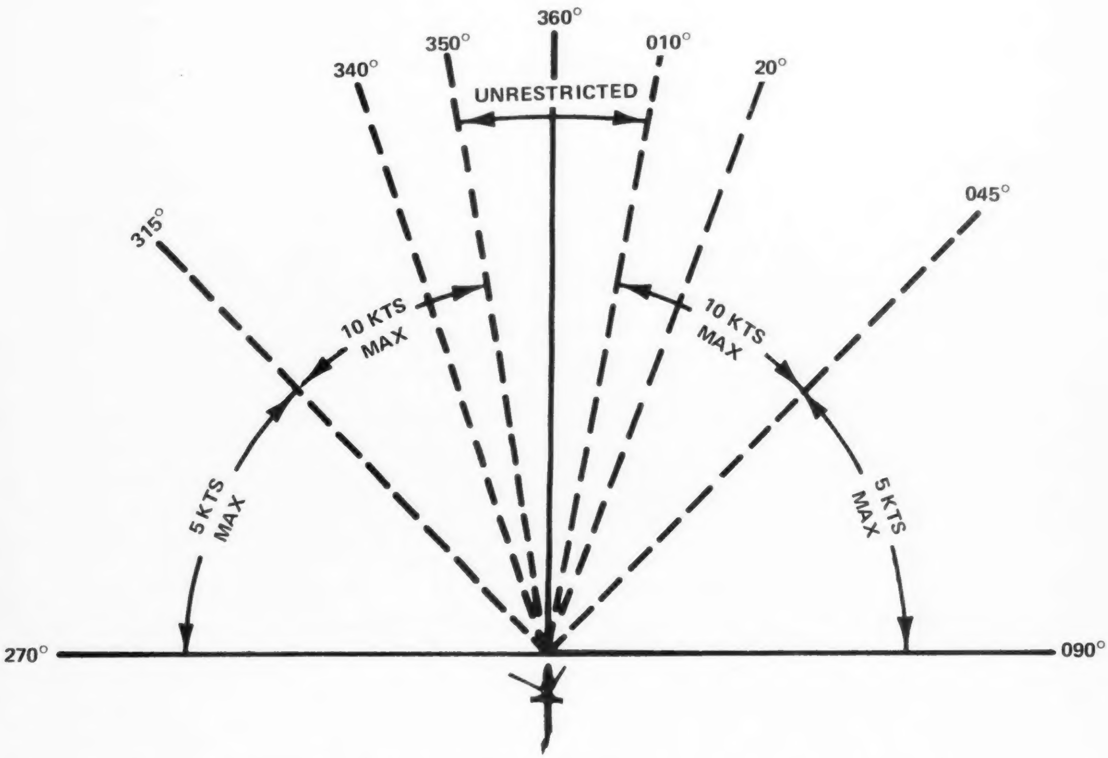
• Helos will not be cleared for takeoff or landing unless the relative wind is within the parameters set forth in Fig. 4 of the CVA/CVS NATOPS Manual. *(See Fig. 1. – Ed.)* These parameters shall be posted in Primary and on the bridge.

• Under night or instrument conditions, helicopters should be launched from the angle deck since the red deck edge outline lights on the port bow provide an excellent reference to the HAC. If a launch must be made from the bow, the minimum distance from the bow shall not be less than 225 feet, neither shall such operations be conducted from a position starboard of the centerline of the axial deck.

• Night and instrument recoveries should be made under the control of CATCC and by the pilot's reference to the mirror/optical landing system. Helicopters shall arrive at the ramp in a stabilized flight condition and then should be air taxied up the angle to an assigned spot. When the aft portion of the angle deck is not clear, a helo may make an approach to the ramp, slide over to port, fly up the port side, and slide in for landing only if the ship maintains BRC (base recovery course) and the white floodlights are on.

The preceding should be discussed and understood by all supervisory personnel involved with helicopter operations. This message should be reviewed quarterly at safety standdowns to ensure awareness and compliance.

Only through persistent and combined efforts of all concerned can we reduce helicopter mishaps.



Maximum Relative Wind Velocity for Night and IFR Helicopter Launches and Recoveries

Fig. 1

Letters

Certified?

NAS Whiting Field – Re the article "Certified?" in the JUN '74 APPROACH. I couldn't agree more! The certification program simply isn't doing what it's supposed to be doing; i.e., providing proper, adequate, and safe facilities for aircraft operations.

I served as flight/hangar officer with Fleet Training Group, Guantanamo, and had the opportunity to inspect and evaluate most ships of the Atlantic Fleet having aviation facilities. I found it alarming that the quality of those facilities was considerably less than the minimum established for certification.

It would seem that either the minimums are too rigid or else too little attention is given to meeting the minimums. Since waivers can be issued so readily, perhaps there is little incentive to meet these minimums. In any case, it's about time for those responsible to ensure that ships meet minimum certification standards.

LCDR B. W. Fordham
Ass't. Operations Officer

Certified? (more)

Buffalo, NY – The article regarding the need for a more definitive process to ensure the safety of the helicopter pilot at sea is misleading. I feel it does not do justice to shipboard navymen who are striving to minimize the danger inherently present whenever the two come together.

I can understand the helo pilot's need when he's placed in a position of "watching out for his own tail rotor." Nevertheless, shipboard personnel spend many hours training (schools, lectures, films, etc.) to be qualified to look out for "his" tail rotor.

Safety *IS* everyone's business, whether you're a jet jockey, hover lover, or one who sails a ship at sea.

I've served a good portion of my career aboard destroyers and can say that in every ship certified to handle helicopters, much hard work was required to obtain the qualification. In certain instances, a waiver has to be obtained because of operational readiness requirements. So, there's no mystery when a waiver is granted for that reason.

From the TYCOM to the checkman or pusher (and everyone else assisting in helo operations), safety of the helo pilot and crew is the prime factor. Department heads know the certification requirements, and helicopter operations are not haphazard, as the article says.

Contrary to the author's belief, there are periodic shipboard inspections (as well as squadron, TYCOM, and Fleet training), and there are ships that fail certification because of the high standards required to ensure safe operation of the helo and ship.

I know that no CO of any ship equipped to handle helicopters takes certification lightly. The ultimate responsibility of that ship rests solely on his shoulders for any incident that occurs. Safety of helo operations will be enhanced through positive, hard-nosed, certification procedures. This *does* exist and is getting better.

LCDR R. F. Castrucci

• **The certification program has been a positive step forward in making helicopter operations better and safer. There are shortcomings, to be sure, but they can be improved by shipboard personnel and helo operators knowing what problems each other faces. There seems to be few gripes about certification; rather, the big problem is the waiver process.**

Personnel aboard ships granted a waiver know that deficiencies exist in their capability to land or service helicopters. It behooves them to exercise extra caution during flight operations. Similarly, helo crews operating with ships granted a waiver know that operations will not be routine, but often don't know why the ship is waivered.

Communications between the bridge and the helo is important. Information must be passed both ways to make flight operations safe.

A Slight Crunch

FPO, New York – The driver of a baggage cart was backing up to a C-118 and lost sight of the director. Attempts were made to stop the cart operator as he got closer and closer, but he rammed into the side of the aircraft.

At the time, it was raining hard, and the wind was blowing about 40 knots. Additionally, a power unit was running, and the noise level was too high to hear anything – even a whistle.

When a big transport is loading or unloading, there's a great deal of activity going on, and I suggest each base make a survey to make sure that whatever is needed to prevent crunches is on hand – and used. If such were done, maybe some of the ground accidents and crunches could be prevented.

The crunch I described happened at Keflavik, and those guys are always working against high winds and cold, plus man-made hazards. Perhaps better

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: APPROACH Editor, Naval Safety Center, NAS Norfolk, VA 23511. Views expressed are those of the writers and do not imply endorsement by the Naval Safety Center.

wands and lights on the equipment would help.

AN Charles E. Mandrell

• Only when qualified drivers carefully operate mobile GSE, under supervision, after a thorough training period will we be able to cut down on crunches.

Re Excess Coffee

NAS Oceana – In the JUL '74 APPROACH, a short article entitled "Excess Coffee" implied that coffee drinkers stand a higher risk of having heart attacks than noncoffee drinkers. Review of the original article (which may be found in the 12 July 1973 issue of the *New England Journal of Medicine)* and an editorial in the same issue demonstrates to me that all the facts have not been assessed.

Medical controversy is one of the fuels from which research and medical discoveries are gleaned. Such controversy belongs in a medical journal, not a safety magazine. APPROACH, an excellent safety magazine, should contain medical facts related to pilot health and aviation safety, not remnants of one medical author's retrospective study.

Requesting that we remove one more enjoyment from life without adequate proof of its injurious effects may result in discouragement and loss of what little progress has been made in the areas of diet control, cigarette smoking, and a daily exercise program – all factors known to influence the development of hardening of the arteries.

LCDR Richard Bloomfield, MC, USNR
Flight Surgeon, VF-101

• The article "Excess Coffee" came from the Office of the Chief of Information. As you note in your letter, and as the article clearly states, it is simply the report of one study.

Further, this is not the first time APPROACH has printed an article on coffee and the heart. See the FEB '64 issue for an original article by LT D. R. Huene, MC, USNR, of the Brookhaven National Laboratories, called "Coffee, the Ubiquitous Navy Liquid."

There's very little in the medical world we could talk about in APPROACH if it had to be a subject that nobody disagreed with. And when the subject is of concern to naval aviators, we respectfully disagree that such controversy does not belong in a safety magazine.

Thanks for your thoughtful letter.

Use the Checklist

NAS Anywhere – While on a fam flight, a senior aviator (under instruction) was attempting simulated single-engine landings in the OV-10A *Bronco*. Some degree of difficulty was encountered due to adverse wind effect at the field. As the flight progressed, the pilot under instruction became determined to make a good landing.

Commencing the simulated emergency condition from the downwind position, the pilot elected to hold his landing gear until established on final approach (this is a common procedure in the OV-10). From this point on, the pilot's attention was focused on flying the proper ground track while fighting a quartering tailwind. Approaching the flare, the instructor pilot (in the rear cockpit) noted that the gear was still up and executed a very close save.

There is no wheels watch at this field, and the tower did not insist on a gear down call. The importance of crew responsibilities must be stressed and stressed and stressed . . .

Name withheld

• Use of the checklist must be stressed also.

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Attention Safety Officers

PLEASE pass this item along.

All Navy motorcycle club presidents are requested to provide the Naval Safety Center with the following:

1. Name and address of command sponsor.
2. Club name, total membership, date established, and mailing address.
3. Names, addresses, and Autovon telephone numbers of club officers.
4. Short history of club and significant accomplishments.
5. Pertinent information that would be of interest to club members at other naval activities.

A list of clubs will be compiled and provided to all who respond. This listing will enable clubs to communicate more effectively with one another and help promote safe motorcycling throughout the Navy. Forward replies to Commander, Naval Safety Center, Code 42, Naval Air Station, Norfolk, VA 23511, or phone Autovon 690-1187.

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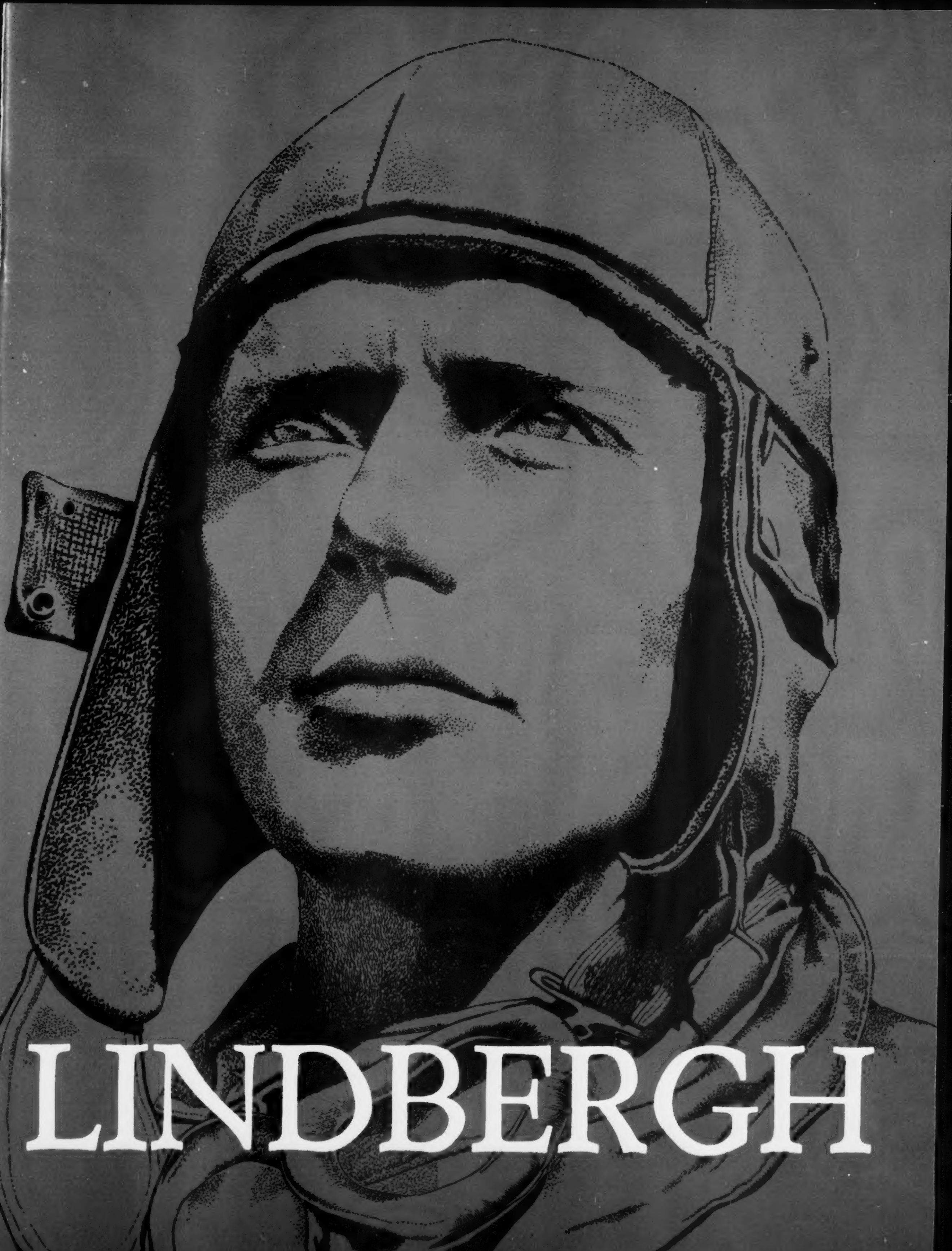

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